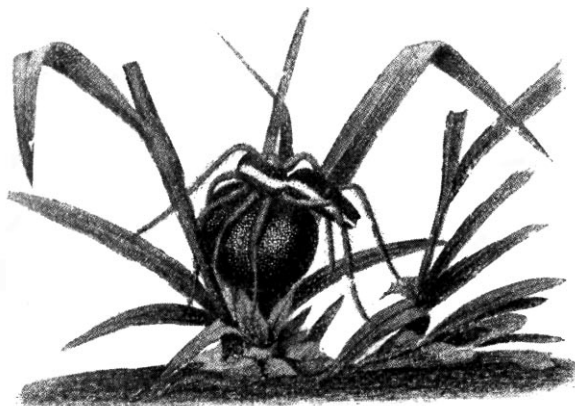


closely his arguments; but that they are worthy of the deepest attention, will be realised by all arachnologists who are acquainted with M. Wagner's previous works.

Perhaps the highest praise that can be bestowed upon this work, is to say that, even when stripped of its theories, it quite reaches the high standard of excellence attained by M. Wagner's previous papers, and that the great value of the theoretical part lies in the fact that



the key to all problems is sought in the hypothesis of evolution by means of Natural Selection.

The memoir is admirably illustrated with ten lithographed plates, of which eight are coloured, and, in addition, with two hundred and fifty-two diagrams in the text. The figure we here select for reproduction, to give an indication of the nature of the rest, represents the female of *Ocyale mirabilis* carrying her cocoon.

R. I. P.

Elementary Practical Chemistry, Inorganic and Organic.

By J. T. Hewitt, M.A., D.Sc., Ph.D., F.C.S., and F. G. Pope. Pp. 42. (London: Whittaker and Co.)

ALTHOUGH the authors of this small book have confined themselves to such parts of elementary qualitative analysis as find a place in Stage I. of the Science and Art Department Syllabus, neither in general plan nor in details of treatment does the book possess any educational advantage over its many competitors. A mere recital of reactions cannot be considered as "Elementary Practical Chemistry." Surely it is possible to present even the array of facts utilised in analysis in such a manner as to comply with the fundamental requirements necessary to be fulfilled by all educational works designed for young students of science. The production of compilations of the present type will probably cease to exist when the new regulations for Organised Science Schools come into force. We may then, perhaps, look for the production of really philosophical text-books arranged on sound educational lines, and yet calculated to minimise the very real difficulties encountered by the beginner. Putting aside these fundamental considerations, it is only just to say that the authors have brought together a strictly limited set of reactions with few positive inaccuracies.

How to Live in Tropical Africa. By J. Murray, M.D. Pp. 252. (London: George Philip and Son, 1895.)

So far as literary merit is concerned, this is a poor book. The text is disjointed, it is too full of unnecessary quotations, and there is too much tautology. But if only the subject-matter is considered, the verdict is that the book is a trustworthy guide to tropical hygiene, and a useful manual on the cause, prevention, and cure of malarial fevers. The importance of such a handy volume to emigrants and visitors to Africa can hardly be overstated. And as the book is the outcome of medical experience, it possesses exceptional value.

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LETTERS TO THE EDITOR.

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. No notice is taken of anonymous communications.]

The Liquefaction of Gases.

PROF. OLSZEWSKI's letter in NATURE of January 10 is a more serious matter than a claim for priority. The letter charges Prof. Dewar with allowing the impression to go abroad that he has carried out much original research into the methods of liquefying the more permanent gases, and the properties of the liquids produced; whereas, according to Prof. Olszewski, most of Prof. Dewar's experiments have been merely repetitions of work done by others.

In his brief communication to NATURE (January 10), Prof. Dewar has been too modest either to defend himself or to meet his opponent. Fortunately, he makes one definite statement:—"A reference to the *Proceedings* of the Royal Institution between the years 1878 and 1893 will be sufficient to remove the suggestion that the apparatus I use has been copied from the *Cracovie Bulletin* of 1890."

I have followed Prof. Dewar's recommendation, and made references to the *Proceedings* of the Royal Institution. In his lecture at the Royal Institution on June 13, 1884 (*Proc. R. I.*, xi. 148), Prof. Dewar refers to Messrs. Olszewski and Wroblewski as having "recently made such a splendid success in the production and maintenance of low temperature." He describes and figures an apparatus which is a slightly modified form of that of the Polish professors, which in turn was derived from the apparatus of Cailletet; and he says: "Provided a supply of liquid ethylene can be had, there is no difficulty in repeating all the experiments of the Russian observers." No claim is made here to originality in the essentials of the apparatus, nor in the experiments performed. The apparatus referred to by Prof. Dewar in his lecture of June, 1884, was used by Prof. Olszewski in 1883, and was improved by him in 1884; in 1887 the apparatus was made capable of liquefying oxygen and other gases in considerable quantities at the ordinary atmospheric pressure (see Olszewski, *Phil. Mag.* February 1895, 189-190). In 1890 the apparatus was so improved that from 30 to 100 c.c. of liquid oxygen could be produced by it (see Olszewski, *Phil. Mag.* February 1895, 192-193). Prof. Olszewski states (NATURE, January 10) that a description of this improved apparatus was sent to Prof. Dewar. A year after this, on June 26, 1891, Prof. Dewar delivered a discourse on Faraday's work at the Royal Institution. The published abstract of this lecture (*Proc. R. I.* xiii. 481) contains a photograph of the pumps and engines used in the laboratory of the Royal Institution, and a photograph of the arrangement of the apparatus on the lecture table; but it is impossible to make out the details of the apparatus from these photographs. So far as can be judged from the *Proceedings* of the Royal Institution, Prof. Dewar did not show large quantities of liquid oxygen, nitrogen, or air in his lectures until June 10, 1892, when he placed before his audience a pint of liquid oxygen. Two years before this Prof. Olszewski had obtained 100 c.c. of liquid oxygen, and he tells us in his letter to NATURE (January 10) that 200 c.c. of this liquid were prepared and exhibited by him in July 1891. A pint is undoubtedly more than 200 c.c., but unless one does something with the larger quantity which cannot be done equally well with the smaller, nothing is gained by conducting the manufacture on the large scale.

I can find no other mention of the apparatus used at the Royal Institution for liquefying large quantities of gases. There is indeed no accurate description in the *Proceedings* of that Institution of the apparatus used by Prof. Dewar. If Prof. Dewar has made marked improvements in any essential parts of Prof. Olszewski's apparatus, why has he not published an accurate description of these improvements in some recognised scientific journal?

A reference to the *Proceedings* of the Royal Institution is then sufficient, not to remove, but to strengthen, "the suggestion that the apparatus I [Prof. Dewar] use, has been copied from the *Cracovie Bulletin* of 1890," or at least that it has been borrowed from descriptions of apparatus devised by Prof. Olszewski.

Every one must admire, and praise the skill which fashioned, the vacuum receiver for storing and experimenting with comparatively large quantities of liquid oxygen and air, which Prof. Dewar used in public for the first time on January 20, 1893, so far as can be gathered from the *Proceedings* of the Royal Institution (see *Proc. R. I.* xiv. 1.) The following sentences occur in the published abstract of Prof. Dewar's lecture on that date: "The prosecution of research at temperatures approaching the zero of absolute temperature is attended with difficulties and dangers of no ordinary kind. *Having no recorded experience to guide us in conducting such investigations*, the best instruments and methods of working have to be discovered." (The italics are mine.) (*Proc. R. I.* xiv. 1.) Now, in June 1890, that is two and a half years before Prof. Dewar made the statement I have quoted, Prof. Olszewski was able to say: "My new apparatus excludes the inconveniences of the former one, and renders it possible to preserve the liquid oxygen a longer time under the ordinary atmospheric pressure." And again: "Thus was solved the problem of liquefying considerable quantities of oxygen without the slightest danger." (See Olszewski, *Phil. Mag.* February 1895, 193-3.) Every reader of Prof. Olszewski's paper will agree that these statements are justified. Moreover, in October 1891, that is, fifteen months before Prof. Dewar declared there was "no recorded experience to guide us in conducting such investigations," Prof. Olszewski (in conjunction with M. Witkowski) described a method for not only storing, but also experimenting with, considerable quantities of liquid oxygen (*Cracovie Bulletin*, October 1891). So far back as 1887 he published, in *Wiedemann's Annalen* (xxxi. 58), a full account of methods for determining the densities of liquid oxygen, nitrogen, and marsh gas. In 1887, *al-o*, he determined the boiling point of liquid ozone, and he began his measurements of the absorption spectra of liquid oxygen and air (*Wiedemann's Annalen*, xxxiii. 570); and in 1891 he published further measurements of the absorption spectrum, and the refractive index, of liquid oxygen (*ibid.* xlii. 663; see also *Phil. Mag.* February 1895, 197-9, and 206-8.)

It is just these properties, namely, the optical properties, of liquid oxygen which had been elaborately studied by Prof. Olszewski from 1887 to 1891 that are largely dwelt on by Prof. Dewar in his discourse of January 1893; and it is the illustration of these properties that is prefaced by the remark, there is "no recorded experience to guide us in conducting such investigations."

On January 20, 1893 (*Proc. R. I.* xiv. 10) Prof. Dewar said that liquid oxygen is "the most convenient substance to use for the production of temperatures about -200°C . Liquid nitrogen, carbonic oxide, or air can conveniently be made at the ordinary atmospheric pressure, provided they are brought into a vessel cooled by liquid oxygen boiling under the pressure of about half an inch of mercury." It is interesting to compare with this Prof. Olszewski's words published in June 1890 (*Crac. Bull.*; I quote from the translation in *Phil. Mag.* February 1895, 192): "I proved long ago [*Compt. rend.* c. 350 (1885)] that liquid oxygen is the best cooling agent; for it easily gives the temperature of -211°C . if the pressure is lowered 9 mm. of mercury, and it does not freeze even at the pressure of 4 mm." It may be said that the similarity between these statements is merely a coincidence. Perhaps it is. Nevertheless, Prof. Dewar's statement conveys the impression that he was the first experimenter to employ liquid oxygen for obtaining, and maintaining, very low temperatures. Another of Prof. Dewar's statements which imply more than they express, occurs in his lecture of June 10, 1892 (*Proc. R. I.*, xiii. 695): "He hoped that even- ing to go several steps further, and to show liquid air, and to render visible some of its more extraordinary properties." Remembering that air had been liquefied by Prof. Olszewski at least eight years before the lecture wherein this statement occurs was delivered, one must regret that Prof. Dewar did not choose words which should have made it impossible for the English public to suppose "that the liquefaction of oxygen and other so-called permanent gases was achieved for the first time by [him]." (See Prof. Olszewski's letter in *NATURE* of January 10.)

Not only does Prof. Olszewski claim to have devised the methods, and constructed the apparatus, for liquefying considerable quantities of the more permanent gases, but he also asserts that most of the experiments on the properties of these liquefied gases which have been performed by Prof. Dewar are

only repetitions, on a larger scale, of work done by others. What, then, are these experiments?

Measurements of the refractive index of liquid oxygen, for the sodium light, and also of the absorption spectrum of liquid oxygen, were published by Profs. Liveing and Dewar in August 1892 (*Phil. Mag.* (5) xxxiv. 205; see also Dewar in *Proc. R. I.*, June 10, 1892; and Liveing and Dewar in *Phil. Mag.* for August 1894). The refractive index of liquid oxygen had been measured, and determinations of the absorption spectrum had been made, by Olszewski and Witkowski in October 1891, and these measurements were the complement of work begun, and published, by Prof. Olszewski in 1887 (*Wiedemann's Annalen*, xxxiii. 570. See Olszewski in *Phil. Mag.*, February 1895, 197-9). It is true that preliminary experiments on the absorption spectrum of liquid oxygen had been made by Profs. Liveing and Dewar in 1889. In their paper in *Proc. R. S.*, June 6, 1889, they say:—"We have observed repeatedly the absorption of liquid oxygen in thicknesses of 8 and 12 mm. Our observations confirm those of Olszewski."

On December 10, 1891, Prof. Dewar announced, in a note to the President of the Royal Society, that liquid oxygen is attracted by the poles of a magnet. This note was followed by another, on December 17, 1891, saying that liquid ozone was also attracted by the poles of a magnet. These detached, but interesting, experiments, which followed up work done by Faraday many years ago, must be placed to the credit of the Fullerton Professor at the Royal Institution.

A paper published in *Phil. Mag.* (5) xxxiv. 326 (1892) by Dewar and Fleming, on the electrical resistances of metals and other bodies at very low temperatures, contains the only piece of exact investigation to which Prof. Dewar's name is attached wherein liquid oxygen or air is used as an instrument of research, with the exception of the measurements of the optical properties of liquid oxygen, which have been shown to be mainly repetitions of the work of Olszewski and Witkowski. This research carries on and supplements earlier work done by Cailletet and Bouty, and by Wroblewski (*Comptes rendus*, ci. 161 (1885)).

A few observations have been made by Prof. Dewar on the phosphorescence of various substances at the temperature of boiling oxygen, and on the cessation of chemical action, and the continuance of photographic action, at the same temperature (see *Proc. R. I.* June 26, 1891 and June 10, 1892, also January 20, 1893; also *Proc. Royal Soc.* April 19, 1894, and *Proc. Chem. Soc.* June 28, 1894). The subject of chemical action at very low temperatures was investigated by Pictet in May and November 1892 (*Comptes rendus*, cxiv. 1245; cxv. 814) in a much more exhaustive way than has been done by Dewar, who has only touched the fringe of the matter (compare also Olszewski, *Phil. Mag.* February 1895, 208-9). The observations on the sensitiveness of the Eastman film at very low temperatures are interesting; but, so far as it has been published, the work is too slight to present material for detailed criticisms; and the same may justly be said of the lecture illustrations of phosphorescence at low temperatures. It may be remarked that Prof. Dewar's paper on photographic action at low temperatures has appeared only in the *Proceedings*, not in the *Transactions*, of the Chemical Society.

Prof. Olszewski's work on the properties of liquefied gases was begun, and accounts of his accurate experiments were published in recognised scientific journals, long before Prof. Dewar's experiments were heard of. The work of the Polish Professor is being continued in the same exact, modest, and scientific manner (see his paper on the optical dispersion of liquid oxygen in *Cracovie Bulletin*, July 1894, noticed in *Phil. Mag.*, February 1895, 208; and his determinations of the boiling and freezing points, and other constants, of argon communicated to the Royal Society, January 31, 1895).

It seems to me that Prof. Olszewski has established a case which demands the instant and serious consideration of those who are truly interested in the advance of science, and are jealous of the good name of the scientific men of this country.

Cambridge, February 7. M. M. PATTISON MUIR.

THE object of the communications on the liquefaction of gases, which have recently appeared in *NATURE* and the *Philosophical Magazine*, is to depreciate the work of Cailletet and Pictet, to smother away the first-class work of the deceased